Summary of Field Activities Associated with North Dakota Oil and Gas Research Council Grant GO13-A: Identification of a Shallow Gas Source System in Southwestern Steele County, North Dakota

November 1, 2007

SUMMARY

Field activities associated with North Dakota Oil and Gas Research Council Grant GO13-A (Identification of a Shallow Gas Source System in Southwestern Steele County, North Dakota), took place during the week of September 3rd, 2007.

The purpose of this activity was twofold. To expanded upon gas detection reconnaissance field work previously completed by the NDGS in Southwestern Steele County, and to collect a gas and water sample for analysis from a shallow NDSWC (North Dakota State Water Commission) observation well. The focus of the project is an NDSWC observation well located in S4 T145N R56W, that when tested in September, 2006, had an FID instrument response of 89.2 ppm (as CH_4), just above the groundwater atmospheric interface (NDGS GI 30, 2006).

During this phase, 21 wells were visited, including the focus well, a privately owned well, and 6 wells in Stutsman County. The privately owned well had been identified for further study by anecdotal evidence provided by the owners that suggested a historical presence of natural gas in their residential water-well system.

Unfortunately, data collected during this phase of the project returned results that were inconsistent with previous field work. Lower than anticipated FID response was measured in the focus well, as well as other, older observation wells in the area (Table 1: Comparison of 2006 and 2007 water well and FID data). It was also noted that water levels between field screening events have shown a net increase between 2006 and 2007 (Tables 2 & 3: hydrographs). The net water level increase may have been due to recent precipitation that potentially resulted in lowering the presence of methanogens due to a temporary oxygenation of the system along with an overall increase of solubility volume. The wells present in the study area are within completely unconfined hydrogeologic conditions, and as such, are much more sensitive to acute temporal environmental influences such as localized heavy precipitation events and subsequent seasonal fluctuations in water tables. In addition, it was discovered that in several recently redrilled and recompleted NDSWC wells, that were field screened for the first time during this field work, that current NDSWC well construction practices permit and continue to use PVC cement on well casing joints. PVC cement is a petroleum based cement adhesive that contains a considerable amount of volatile organic compounds which effectively contaminate the air and water column within a well which results in erroneously elevated values of detected hydrocarbons when monitored.

The inconsistent results obtained in the focus well resulted in the following decisions: It was decided to cap the wellhead for 12 hours with a plastic membrane, and test the FID response well again the following morning. The FID response 12 hours later was measured at 3.2 ppm (as CH_4). This

response is interpreted to show that some methanogens were present, and the system was active. It was also decided that it would be imprudent to collect water samples for the incubation at this time. It was felt that water samples should be collected at a time when more gas is available in the system, in order to improve the probability of successfully incubating methanogens in the laboratory.

The variations of measurable methane in shallow groundwater observed during this phase of the project may indicate a more dynamic, and subsequently, more sensitive system associated with shallow methane generation. The dynamic nature of the shallow methane occurrences found in the Dakota's, is demonstrated by multiple measurements in project scale work. Concentrations show annual and monthly variation, and may respond to a number of factors including parametric variables and precipitation. These variations may in part represent constraints on the field measurement techniques. But, they probably also reflect the dynamic, open or unconfined nature of the late-generation biogenic gas systems that are believed to be forming methane in the shallow and ultra-shallow subsurface environments.

Additional field screening of selected wells in southeastern Stutsman County also showed a suppression of detected gas concentrations, similar to what was found in the wells in Steele Count. However, detected gas concentrations also were shown to have increased in several other wells tested (Table 2). This further supports the conclusion that these ultra-shallow gas systems are likely to be sensitive and responsive to changes in system conditions. Since this was the first time that any temporal aspects of shallow gas field screening have been conducted (i.e. monitoring over time),

what we have since learned is that these types of shallow gas systems are very likely to be more of a variable, rather than consistent, type of methanogenic system. This is important information gained for future exploration and potential production efforts.

The investigators request that the time line of the project be extended, and the scope of the project be modified. With the approval of the NDSWC, we propose to shut-in a series of observation wells in southwestern Steele County, including the focus well. Wells would be shut-in with a removable cap designed to collect gas samples at the well head through a valve. The cap would also include a port that would allow for testing at the water atmosphere interface (figure 3; photograph of well cap). The wells would then be monitored, on a schedule to be determined, for a minimum of two years. Data collected through this process should give valuable insight into the dynamic nature of methanogenesis. During this time frame, should background methane levels significantly increase in the focus well, as will be indicated by continued periodic monitoring, gas and water samples will be collected, analyzed, and the water samples collected incubated for methanogens. With the approval of this request by the NDOGRC, an amended proposal and budget will be prepared and submitted for approval.

BUDGET

To date expenditures have totaled $9421.93. Refer to appendix 1 for details.

Table 1
Shallow Gas FID Field Screening Summary - Steele County

Well Location	2006 FID Response (ppm)	2007 FID Response (ppm)	Screened Interval (ft)	Total Well Depth (ft)
14505413DDD3	146.3	1.9, 3.2*	75-80	100
14505604DDD	89.2	5.4	50-60	60
14505422AAA2	2.0	0.0	74-79	106
14505501DDD2	0.0	0.0	36-41	50
14505408BBB	0.0	0.0	55-60	160
14505417DDD	0.0	0.0	93-98	280
14505409CCC2	0.0	0.0	45-50	58
14505415CCC2	0.0	0.0	78-83	100
14505413AAA2	0.0	0.0	27-32	40
14505410DDD2	0.0	NV	15-20	23
14605709BAA	NV	NF	0-80	80
14505513AAA2	NV	NV	46-51	58
14505405BBB2	NV	NV	35-40	60
14505432AAA	NV	NV	68-73	147
14505427AAA	NV	NV	87-91	200
14505426AAA3	NV	NV	58-63	80
14505414DDD2	NV	0.0	55-60	80
14505413BBB	NV	0.0	75-80	280
14505436CCC	NV	0.0	78-83	280
14505425CCC2	NV	0.0	75-80	100
14605534DDD	NF	NV	48-51	120
Burchill Private Well	NV	0.0	30-50	50

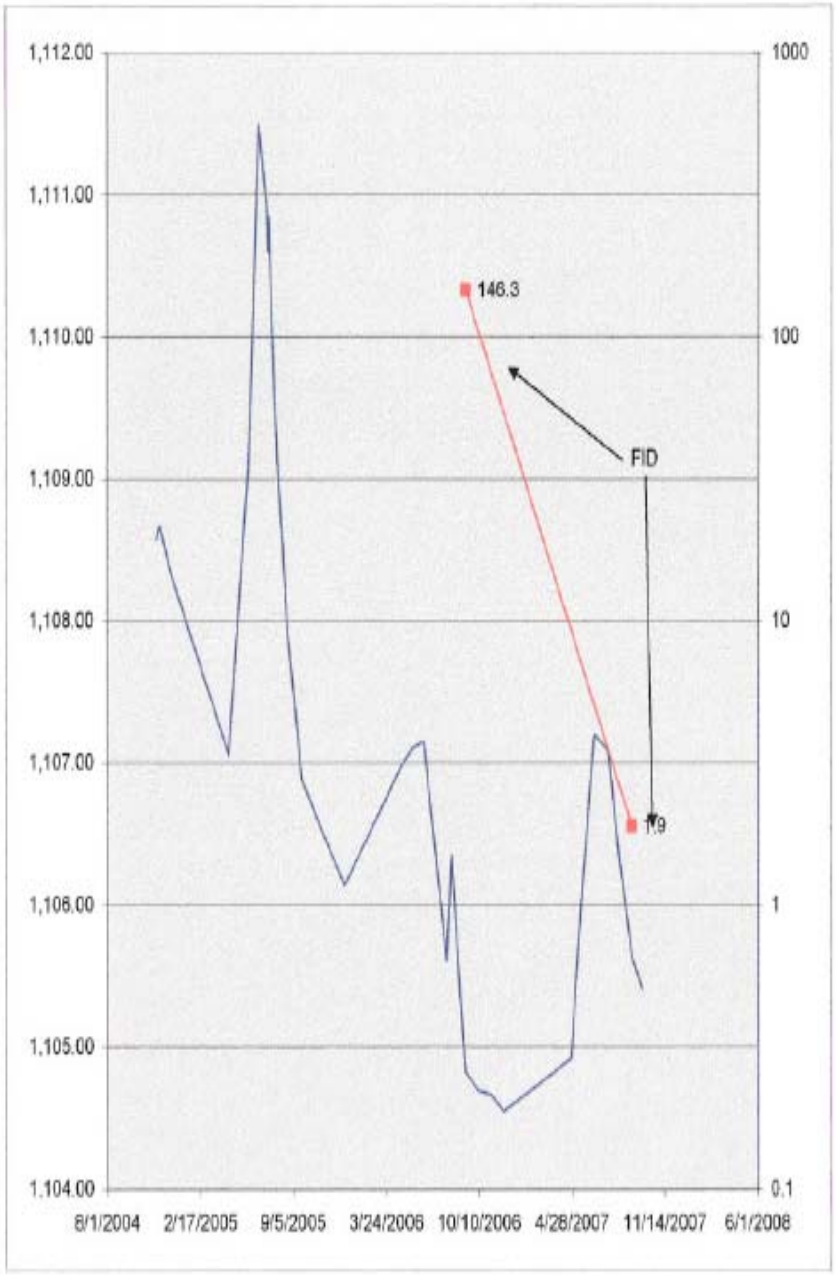
* 3.2 ppm result recorded on 9/6/07 after 12 hour shut-in period.
NF = Well not found at prescribed location. Presumed abandoned or destroyed.
NV = Well location not visited during this investigation.

Table 2
Shallow Gas FID Field Screening Summary
Stutsman County

Well Location	2006 FID Response (ppm)	2007 FID Response (ppm)	Screened Interval (ft)	Total Well Depth (ft)
14006227CCC1	48.5	0.8	258-264	280
14006229CCC3	30.6	0.0	45-50	55
13706229CDD	182.0	2.0	157-163	260
13706230BBB1	0.0	0.6	217-220	247
13706230BBB2	65.1	155.4	134-140	NA
13806231CCC1	44.3	53.3	121-126	143

Table 2: Hydrograph; 145-054-13 DDD3

Date Measured	Measuring Point Elevation (ft)	Depth (ft) Below Measuring Point	Water Level Elevation (ft)	Data Source
9/26/2007	1,118.09	12.68	1,105.41	NDSWC
9/3/2007	1,118.09	12.44	1,105.65	PO
8/8/2007	1,118.09	11.77	1,106.32	PO
7/15/2007	1,118.09	11	1,107.09	PO
6/15/2007	1,118.09	10.89	1,107.20	PO
5/17/2007	1,118.09	12.1	1,105.99	PO
4/25/2007	1,118.09	13.17	1,104.92	PO
12/2/2006	1,118.09	13.54	1,104.55	PO
11/4/2006	1,118.09	13.42	1,104.67	PO
10/8/2006	1,118.09	13.39	1,104.70	PO
9/11/2006	1,118.09	13.26	1,104.83	PO
8/12/2006	1,118.09	11.74	1,106.35	PO
8/1/2006	1,118.09	12.48	1,105.61	NDSWC
7/11/2006	1,117.18	10.9	1,106.28	PO
6/13/2006	1,117.18	10.03	1,107.15	PO
5/20/2006	1,117.18	10.07	1,107.11	PO
4/22/2006	1,117.18	10.22	1,106.96	PO
12/24/2005	1,117.18	11.04	1,106.14	PO
11/24/2005	1,117.18	10.8	1,106.38	PO
10/25/2005	1,117.18	10.56	1,106.62	PO
9/24/2005	1,117.18	10.29	1,106.89	PO
8/23/2005	1,117.18	9.19	1,107.99	PO
8/4/2005	1,117.18	8.08	1,109.10	NDSWC
7/29/2005	1,117.18	7.64	1,109.54	PO
7/20/2005	1,117.18	6.83	1,110.35	NDSWC
7/16/2005	1,117.18	6.37	1,110.81	NDSWC
7/15/2005	1,117.18	6.33	1,110.85	NDSWC
7/14/2005	1,117.18	6.58	1,110.60	NDSWC
7/13/2005	1,117.18	6.46	1,110.72	NDSWC
7/12/2005	1,117.18	6.39	1,110.79	NDSWC
7/11/2005	1,117.18	6.26	1,110.92	NDSWC
6/24/2005	1,117.18	5.68	1,111.50	PO
6/1/2005	1,117.18	8.12	1,109.06	PO
4/20/2005	1,117.18	10.12	1,107.06	PO
12/14/2004	1,117.18	8.82	1,108.36	NDSWC
11/22/2004	1,117.18	8.51	1,108.67	NDSWC
11/15/2004	1,117.18	8.6	1,108.58	NDSWC



FID Data

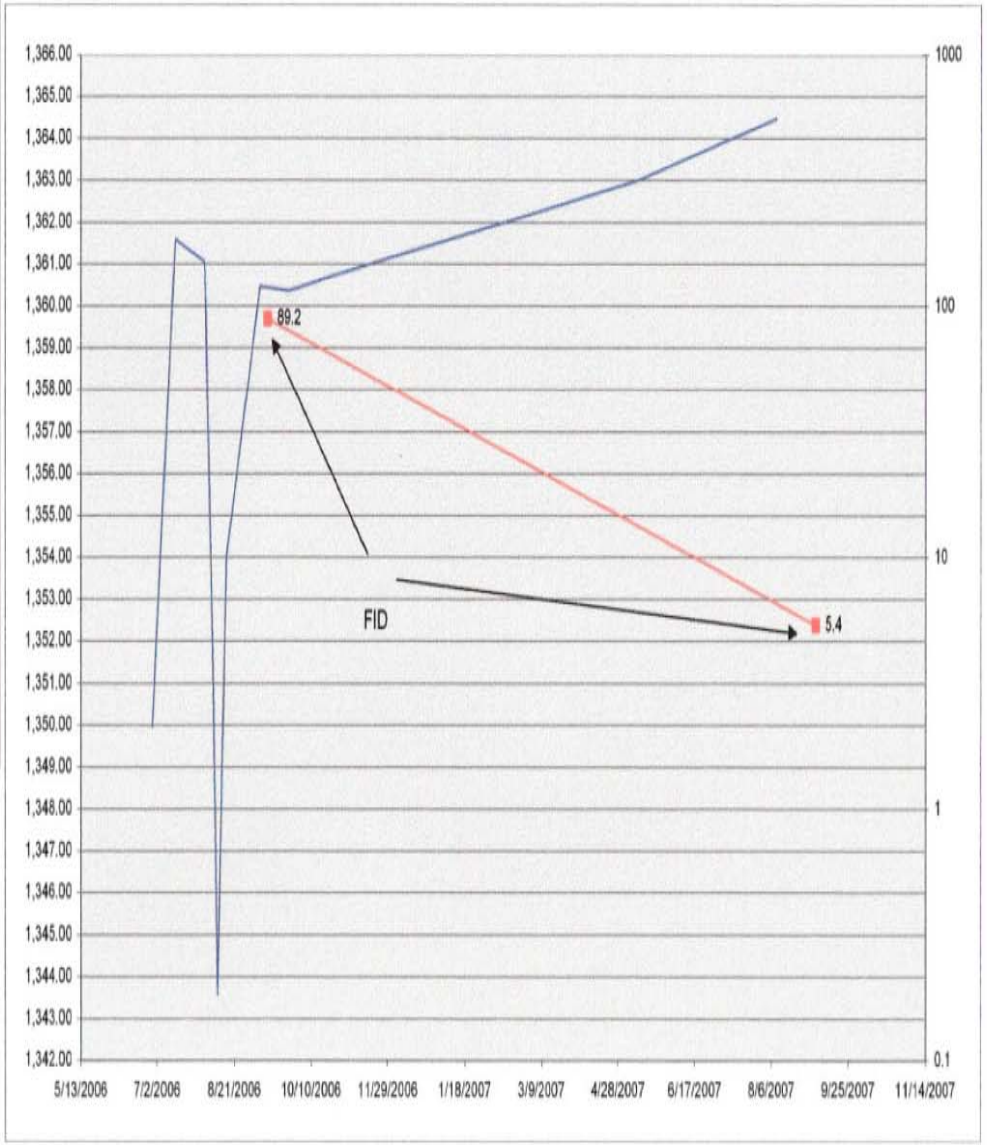
9/12/2006	146.3
9/4/2007	1.9

Data Source: NDSWC=ND State Water Commission, USGS=US Geological Survey, NDGS=ND Geological Survey, NDHD=ND Health Dept., NDSU=ND State University, USBR=US Bureau of Reclamation, PO=Private Observer

Table 3: Hydrograph; 145-056-04 DDD

Date	Measuring Point	Depth (ft) Below	Water Level	Data
Measured	Elevation (ft)	Measuring Point	Elevation (ft)	Source
8/9/2007	1,370.00	5.52	1,364.48	NDSWC
5/10/2007	1,370.00	7	1,363.00	NDSWC
10/25/2006	1,370.00	9.26	1,360.74	NDSWC
9/26/2006	1,370.00	9.63	1,360.37	NDSWC
9/7/2006	1,370.00	9.52	1,360.48	NDSWC
8/16/2006	1,370.00	15.95	1,354.05	NDSWC
8/10/2006	1,370.00	26.41	1,343.59	NDSWC
8/7/2006	1,370.00	18.23	1,351.77	NDSWC
8/2/2006	1,370.00	8.94	1,361.06	NDSWC
7/14/2006	1,370.00	8.4	1,361.60	NDSWC
6/29/2006	1,370.00	20.03	1,349.97	NDSWC

Data Source: NDSWC=ND State Water Commission, USGS=US Geological Survey, NDGS=ND Geological Survey, NDHD=ND Health Dept., NDSU=ND State University, USBR=US Bureau of Reclamation, PO=Private Observer



FID Data

9/12/2006	89.2
9/4/2007	5.4

APPENDEX 1: BUDGET EXPENDITURES

Project Costs			
		Expenditures	**to Date**
FID Equipment Rental	$2,000.00		
Miscellaneous Field Costs	$250.00		
Laboratory Cost			
culture 2 water samples*	$2,800.00		
Consultant Fees & Expenses			
Labor @ $125/hr (4 weeks)			
travel/lodging/perdiem	$20,000.00	$3,500.00	
NDGS Fees & Expenses	$1,575.00	$897.32	
Labor/travel/lodging/perdiem			
Final report editing and publishing as NDGS Geological Investigation	$2,000.00	$ 901.50	Labor
	$1,600.00		
Total	$30,225.00		
Summary of Matching Funds			
Cash Contribution			
	$4,000.00	$508.79	Fischer; travel/lodging/perdiem
NDGS Fees & Expenses	$3,600.00	$ 614.32	Anderson, travel/lodging/perdiem
Labor Contribution			
Fischer Oil & Gas			
GeoShurr	$5,000.00	$3,000.00	
	$2,500.00		
TOTAL	$15,100.00	$9,421.93	